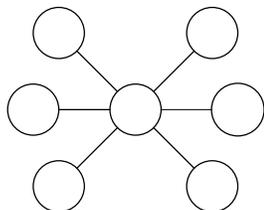**Rules: 90 minutes; no electronic devices.** The positive integers are 1, 2, 3, 4, ...


**1.** Find the largest integer n that satisfies both $61 < 5n$ and $n^2 < 199$.

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2. The seven integers 1, 2, 3, 5, 7, 9, and 11 are placed in the circles in the figure, one number in each circle and each number appearing exactly once. If all three straight-line sums are equal, then (a) what is that sum; and (b) what number is in the center circle?

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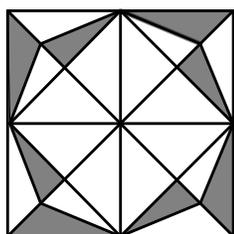
3. Find the total area of the eight shaded regions. The outer square has side length 10 and the octagon is regular, that is, its sides all have the same length and its angles are all congruent.

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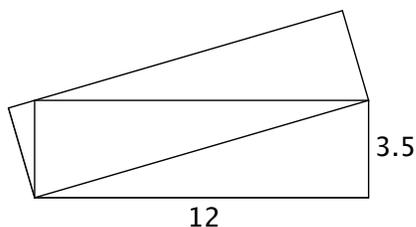
4. The bottom rectangle in this figure is 3.5 units high and 12 units wide. How long is the shorter side of the upper (tilted) rectangle?

3.5

12

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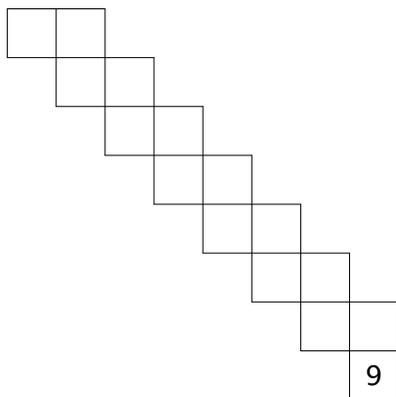
5. List the numbers from fifteen to one,
in permuted order, shrewdly done:
both across and down, in each line two neighbors share
every twosome sums to a perfect square.
If the last entry is the number 9,
find the leftmost entry in the top line.

9

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6. The Seripian unit of money is the pit, and Seripian coins come in only two types: 5-pit coins and 6-pit coins. What is the largest value that cannot be represented with Seripian coins? For example, 16 can be represented as $5 + 5 + 6$, but neither 8 nor 13 can be represented.


TURN PAGE OVER

7. The table lists the number of teeth on each of thirteen consecutive intermeshed gears.

Gear :	1	2	3	4	5	6	7	8	9	10	11	12	13
Teeth :	144	36	24	60	48	15	17	144	72	34	12	12	144

6th gear, 15 teeth   7th gear, 17 teeth
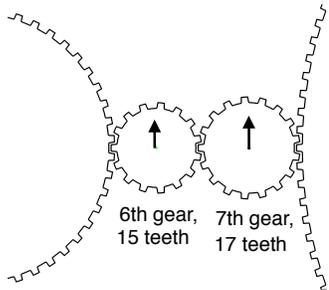
Each gear is marked with an arrow, and initially all the arrows are pointing straight up. After how many revolutions of the first gear are all the arrows again pointing straight up for the first time? The diagram shows the sixth and seventh gears in the line.
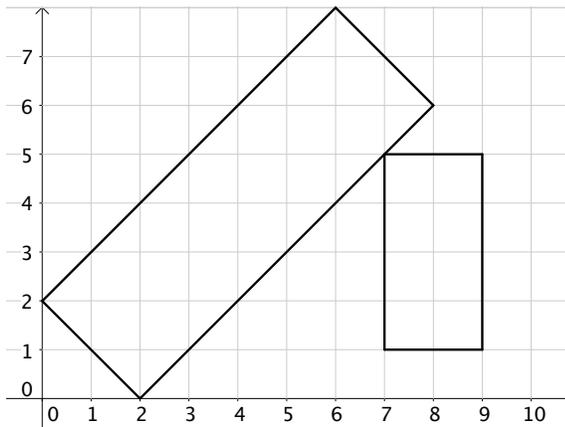
8. Draw one straight line that cuts both rectangles so that each of their individual areas is split in half. At what value of y does this line cross the y axis?

9. A point (x, y) whose coordinates x and y are both integers is called a *lattice point.* How many lattice points lie strictly inside the circle of radius π centered at the point $(0,0)$? Recall that $\pi = 3.14159\ldots$

10. Find a set of three consecutive odd integers $\{a, b, c\}$ for which the sum of squares $a^2 + b^2 + c^2$ is an integer made of four identical digits. (For example, 2222 is an integer made of four identical digits, and $\{7, 9, 11\}$ is a set of three consecutive odd integers.)

Attendant's Order of Packing Buses

11. A parking lot for 30 buses has 5 rows and 6 columns. Every day in January the buses depart heading north as columns: column C1 departs first, then C2 departs, ..., so that the first bus to leave is the one in the first row, first column, the second bus out is the one in the second row, first column, etc. Each evening the buses return to the lot in their order of departure (first bus out is first bus in; etc.). An attendant parks the returning buses so they face north, filling the rows systematically, working from the southernmost row 5 to the northernmost row 1, in the snaking zig-zag order depicted. Call the locations of the buses on the morning of January 1 their original home positions. On what evening(s) in January will the attendant park the most buses in their original home positions?

END OF CONTEST